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CITATION:

ITO, Masaaki. CHANGES IN THE DISTRIBUTION OF THE !NARA PLANT THAT AFFECT THE LIFE OF THE TOPNAAR PEOPLE IN THE LOWER KUISEB RIVER, NAMIB DESERT. African study monographs. Supplementary issue 2005, 30: 65-75

ISSUE DATE:

2005-03-31

URL:

https://doi.org/10.14989/68460

CHANGES IN THE DISTRIBUTION OF THE !NARA PLANT THAT AFFECT THE LIFE OF THE TOPNAAR PEOPLE IN THE LOWER KUISEB RIVER, NAMIB DESERT

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ABSTRACT The !Nara plant is endemic to the central Namib Desert. The Topnaar people, who live along the Kuiseb River, use this plant in their daily lives, as it serves as a vital source of income, nutrition, and traditional culture. !Nara is virtually the only food source of the Topnaar during harvest time, and cash can be obtained by selling the seeds of the !Nara fruit. In fact, 40% of Topnaar harvesters have no other source of income. A flood protection wall was built in 1961 to protect Walvis Bay from flood damage, and a tributary that once flowed to the town was dammed as a result. A large percentage of !Nara was killed, and the crop yield decreased dramatically. The loss of floodwaters following the construction of the wall likely resulted in a decreased moisture supply, causing !Nara vegetation to suffer. It is probably difficult for seeds to germinate owing to the decreased flooding erosion, the increased accumulation of sand, and the lowered groundwater table.

Key Words: !Nara; Topnaar; Namib Desert; Flood; Groundwater.

INTRODUCTION

Namibia is located in southwestern Africa and has an arid climate (Fig. 1). The Namib Desert, which is characterized by a desert climate, extends along the Atlantic coast. The Kuiseb is an ephemeral river that flows from the central region of the Namib Desert to the Atlantic Ocean and forms the Kuiseb delta. A unique plant, the !Nara (The '!' is an original click sound of Nama.) (*Acanthosicyos horridus*) (Fig. 2), is endemic to this area.

The Topnaar people who inhabit this region have long used the !Nara as a source of food and income (Seely, 1973; Budak, 1977; Shilomboleni, 1998), and depend heavily on it for sustenance. However, the conditions for !Nara growth have deteriorated, and crop yields have decreased in recent years (Shilomboleni, 1998). The cause of this deterioration remains unclear, as does the extent of its influence on the life of the Topnaar.

Although a detailed description of !Nara use is unavailable, several researchers have studied the use of this plant by the Topnaar (Ross, 1971; Budak, 1977; Dentlinger, 1977). Archeological research (Berry, 1991) and ecological studies (Kilopateck & Stock, 1994; Moser, 2001) have not revealed evidence of a similar decline in !Nara growth.

In this study, I examined the relationship between the !Nara plant and the Topnaar people, the influence of !Nara crop deterioration, and the cause of the crop decline. First, the use of !Nara by the Topnaar is discussed in detail, with

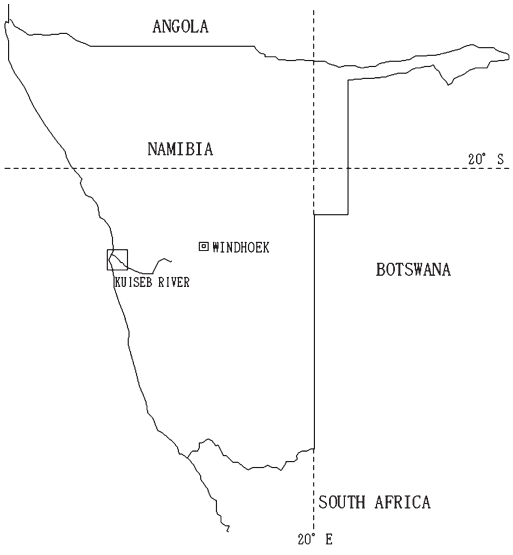

Fig. 1. Location of Namibia and Kuiseb River.

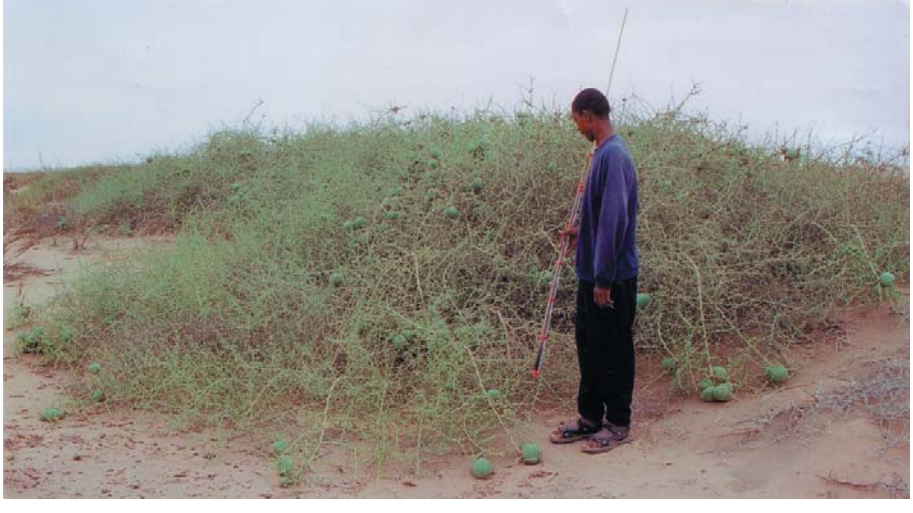

Fig. 2. !Nara (*Acanthosicyos horridus*).

particular attention given to changes in the lives of people and in the !Nara crop. Next, the social and ecological background of the decrease in crop yields is analyzed. Finally, the current situation facing the Topnaar and their future prospects are examined.

OUTLINE OF THE STUDY AREA

I. Namib Desert

The Namib Desert is one of the oldest deserts in the world (Seely, 1976; Ward, 1984). Namib is a Nama word that means "vast, dry land." This desert stretches about 140 km from east to west and about 2,000 km from south to north, from the northern part of the Republic of South Africa, across Angola, and to the coast of Namibia. The total area of the Namib Desert exceeds 140,000 square kilometers, and it borders the Atlantic Ocean for much of its length. A part of the Namib Desert is set aside as the Namib National Park, the fourth largest national park in the world.

The Namib Desert is a coastal desert that formed only within about 80–140 km of the Atlantic coast. The cold Benguela Current, which flows north from Antarctica, cools the coastal waters, forming a stratification of warm and cold atmospheric layers, thereby impeding the atmospheric circulation necessary for the formation of rain clouds. As a result, the coastline experiences an extremely dry climate, with an average precipitation of 15 mm per year. In contrast, the eastern side of the desert receives an average yearly precipitation of about 100 mm, owing to the waning influence of the Benguela Current. However, as there are some regions in which precipitation has not been recorded at all during the past 20 years (Seely, 1976), the Namib Desert is considered one of the driest regions in the world.

Despite these low levels of precipitation, fog generation is widespread throughout the coastal region of the Namib Desert. Cold air from the sea cools the warm air over the land in a process similar to that of rain cloud development, and the fog rises. Moving inland from the coast, the dominant southwesterly winds can carry the fog over 30 km in one morning. It is not unusual for the fog to travel 100 km or more from the coast. The fog generated by this process generally develops by sunrise, dissipates as the temperature rises, and often disappears entirely by noon. Fog, though ephemeral, is a valuable source of moisture in this harsh environment (Seely, 1976).

II. Kuiseb River Valley and the Study Village

Walvis Bay is located 30 km north-west from the research area. The rain and temperature charts for Walvis Bay record a yearly rainfall of less than 10 mm and relatively low temperatures.

The combination of moisture from fog and from the Kuiseb River enables life to exist in this severe environment (Ross, 1971; Seely, 1976). The Kuiseb River collects water in the Khomas Highlands, where the average precipitation is 300–400 mm per year, and flows west toward the Atlantic Ocean through the central region of the Namib Desert. The Kuiseb River spans about 440 km and has two tributaries. One flows to the north, toward the city of Walvis Bay about 30 km from the coast, and the other flows to the west, directly to the

Atlantic Ocean. During flooding, the Kuiseb River flushes the sand that has accumulated from the movement of the dunes and controls the north-to-south shifting of the dunes (Goudie, 1972).

Oases are generally found in the central part of the desert, where they supply valuable moisture to plants and animals. The Kuiseb River performs a similar role, forming an oasis not at isolated points, but as a line that stretches across the Namib Desert. *Faidherbia albida* and *Acacia erioloba* grow profusely along the riverbed and offer shade to the jackals and oryx that live in the Kuiseb River valley, and their leaves and pods provide food for the goats of the Topnaar.

Twelve Topnaar settlements lie within about 150 km east and west of the Kuiseb River, with a total population of about 500 people. This study was conducted in the village of Aramstrat, which includes 51 people. The village is close to the !Nara harvest area and is therefore a useful site for examining the relationship between the people and the !Nara plant.

ECOLOGY AND DISTRIBUTION OF THE !NARA PLANT IN THE KUISEB DELTA

I. Botany of !Nara

!Nara is a cucurbitaceous plant that is distributed primarily in the lower Kuiseb River, although it is also widely distributed along the coast of the southern part of Angola. During the 19th century, Friedrich Welwitsch established that !Nara is endemic to the area and has existed along the coast of Namibia since about 40 million years ago (Berry, 1991).

The multiple greenish branches of the !Nara plant are covered by thorns about 2–3 cm long, which conduct photosynthesis in lieu of leaves. The body of the plant is referred to as a "hummock" because it collects the sand around the stalk during its growth, forming a slightly elevated mound. One hummock may grow up to 1,500 m^2 or more (Klopateck & Stock, 1994).

The roots of a !Nara can extend 30 m deep to obtain moisture, and the plant also absorbs water from the fog that rises in the morning. Water is stored in the roots to prevent evaporation under the extremely arid conditions of the Namib Desert.

The fruit of the !Nara plant, the !Nara melon, is edible, and the cream-colored seeds are called butter nut. !Nara melon can grow to about 1 kg and 15–20 cm in diameter (Klopateck & Stock, 1994). Of 100 fruits harvested, each fruit had an average weight of 667 g, of which butter nut comprised 52.2 g. The !Nara melon contains a high percentage of moisture, and the butter nut is highly nutritious, with 32% protein and 46% oil (Pfeifer, 1979). This fruit sustains not only wild animals such as jackal, oryx, springbok, mice, and the !Nara beetle, but also the people who live in nearby areas (Pfeifer, 1979; Kilopateck & Stock, 1994).

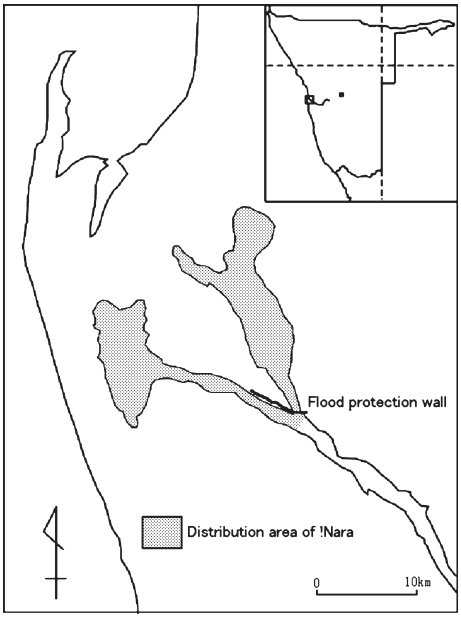

Fig. 3. Distribution of !Nara in 1977.
(from the aerial Photograph of 1977)

II. Distribution Region of !Nara in the Kuiseb Delta

Fig. 3 shows the distribution of the !Nara plant in 1977. !Nara is distributed from the bend in the Kuiseb River to the coastline near the river. The region where !Nara is distributed, the !Nara fields, is characterized by vegetation that differs from that of the Kuiseb riverbed, especially with respect to acacia trees.

Flooding erodes the mounds covered by Nara!, which contributes to the germination and regeneration of individual plants. The moisture supplied to the soil is thought to favor the renewal of vegetation. Flooding is therefore thought to play a vital role in the growth of the !Nara plant.

TOPNAAR LIFE AND !NARA

I. History of the Topnaar as a Society and as an Economy

Topnaar is a part of the Nama branch of the Khoisan language group (Eynden, *et al*., 1992). The Topnaar, or #Aonin (The '#' is an original click sound of Nama, too.) in the Nama language, live in and around the lower Kuiseb River and Sesfontein area, stretching 500 km from Walvis Bay to the north (Budack, 1977). Some of the Topnaar people who had lived in the Sesfontein area migrated to the lower Kuiseb River region during the 14th century (Eynden, *et al*., 1992).

These people have historically been fishermen, goat-herders, and !Nara harvesters. Old records contain accounts of the Topnaar offering beef, goat meat, milk, water, and !Nara fruits to European trade ships in exchange for general merchandise, clothes, weapons, and alcohol.

The main occupations of the Topnaar are goat husbandry and !Nara cultivation. Harvesting is mostly undertaken by men, but women occasionally assist in the harvest when necessary. Goats are kept in every home, sometimes in great numbers, and are pastured in the Kuiseb riverbed during the daytime, returning to the village in the evening. The primary means of generating income for the Topnaar is by selling butter nuts and goat skins or through paid labor. Goat skins are taken to the city to be sold, while the meat is retained for private consumption.

A few people work in the nearby mines and towns such as Walvis Bay and Swakopmund. In Aramstrat, only one person worked in the town regularly, although some individuals worked temporary, seasonal jobs. Payment for work in the mines is low, usually only about N$100–150. However, because of the high unemployment rate in Namibia, there are many applicants for work. The government supplies a monthly pension to men and women over the age of 60, which is a vital source of income for the community, but the most important source of income for the Topnaar is the sale of !Nara butter nut. The money obtained is used to buy food, such as maize flour and salted cow bone, and to pay for medical and educational expenses.

II. Use of !Nara

Although !Nara bears fruit throughout the year, there are two primary harvesting periods. The first is the shorter harvesting season from August to September, and the longer season runs from late December to late March. Harvesters go to the !Nara fields either alone or with their families to collect !Nara fruits; on site, they live in small, simple huts.

The method of harvesting is quite simple. Workers poke the !Nara melons with long sticks, separating them from the branches. It is often difficult to distinguish if the fruit is ripe enough; generally, when the inside is orange, the fruit is ripe enough to harvest. Harvested !Nara melons are collected in a large drum and returned to the huts in donkey carts.

III. Eating Habits

A typical example of cooking with !Nara is the !Nara cake. !Nara fruit is boiled and stirred with a long stick in a large drum until it has been reduced to half its volume. The seeds are separated from the liquid during the boiling process and are extracted. The liquid is then dried on a sand dune or a plastic sheet for several days. !Nara cake is eaten alone or with cooked maize.

After the time-consuming work of removing the husks from the seeds, butter nuts that has been coated with sand are cooked in a pan until it is light brown,

after which the sand is removed by rubbing it off by hand.

IV. Economic Activities

The cooked seeds are bagged and sold in town, after reserving some for the villagers. Cooked seeds can usually be stored for up to two years without spoiling. According to interviews with 25 !Nara harvesters, the amount of harvested !Nara averages about 490 kg per year per person, of which about 200 –250 kg are sold. Because the butter nut is sold for N$6–8 per kg, the average profit from the sale of butter nut is about N$1200–2000 per year. This income is very important to the Topnaar people, because 40% of the harvesters have no other source of income, and 43% of the average annual income is from selling seeds. The dependency of the Topnaar on the !Nara plant is clearly quite high.

INFLUENCE OF VEGETATION CHANGES ON !NARA

I. Vegetation Change and Its Causes

!Nara plants grow across a wide area of the Kuiseb delta. However, since a flood protection wall was constructed in 1961, the distribution of !Nara in the Kuiseb delta has been dramatically reduced. The flood protection wall, constructed by the South African government, protects the harbors of the city of

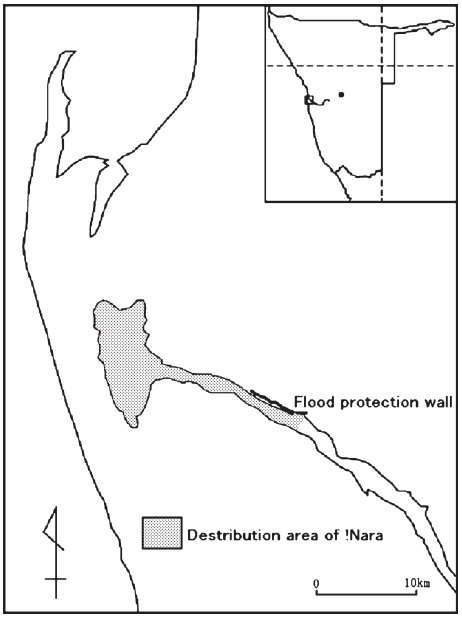

Fig. 4. Distribution area of !Nara in 1997. (from the aerial photograph of 1997)

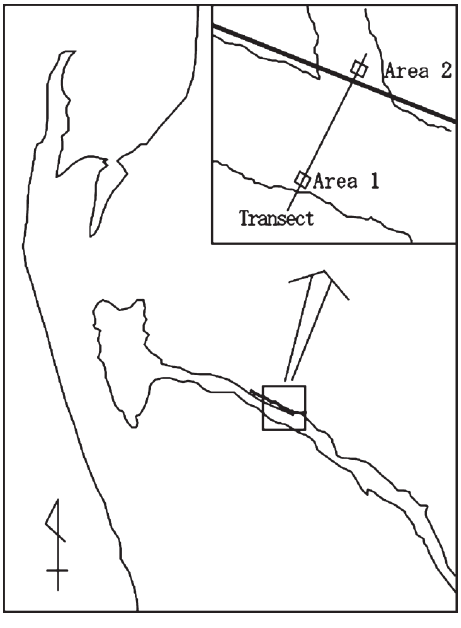

Fig. 5. Transect and cross-sectional area.

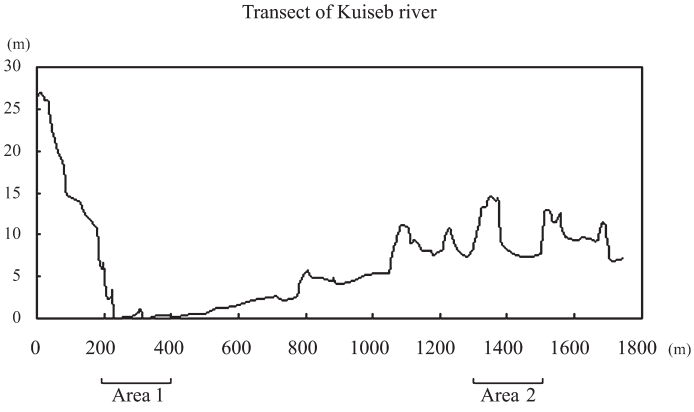

Fig. 6. Transect of Kuiseb River.

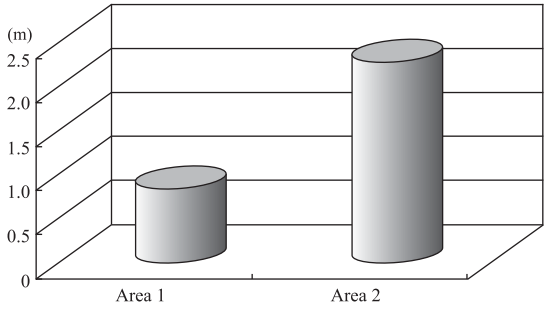

Fig. 7. Average height of one mound.

Walvis Bay downstream from the Kuiseb River, which floods every 8 to 10 years.

Fig. 3 shows the distribution of !Nara in 1977. Sixteen years after the construction of the wall, !Nara were scattered and sparsely distributed both along the tributary and the main river. Aerial photography confirms the presence of vegetation such as bushes and herbs in 1977, but by 1997 (Fig. 4), !Nara along the tributary had disappeared and was observed only in the sand dunes. This may be owing to a lack of water flowing from the tributary, gradually retarding the growth of !Nara. According to one harvester, crops were plentiful and healthy throughout the 1980s, despite the existence of the protection wall, but diminished rapidly during the 1990s.

To examine this phenomenon, I tracked !Nara vegetation in the Kuiseb delta from the time of the construction of the wall through the next 40 years. The distribution of vegetation was investigated by taking a cross section of both the main river and the tributary, and then delineating surrounding areas of 200 × 200 m (Fig. 5). The area established in the primary branch of the Kuiseb River was labeled Area 1, and the area near the tributary was Area 2 (Fig 6). The auther recorded the area covered by each plant, the rate of withering of each plant, and height of each mound.

The mound heights of the plants in Area 2 were about three times higher

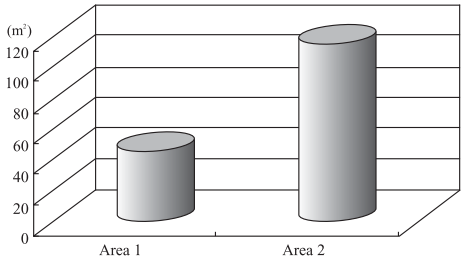

Fig. 8. Average area of one mound.

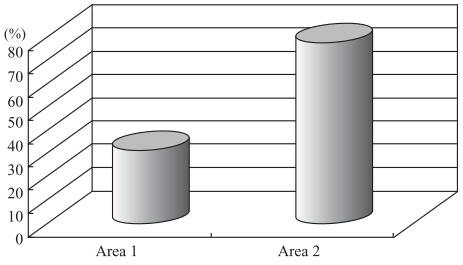

Fig. 9. Average death rate of one mound.

than those of Area 1 (Fig. 7). This may be because water stopped flowing to the area after the construction of the wall, allowing the unimpeded build-up of sand. Additionally, the area covered by plants in Area 2, 115.8 m^2, exceeded that of Area 1, 46.2 m^2 (Fig. 8). Finally, the rate of individual plant withering (70%) of the plants in Area 2 was at least twice as much as that of in Area 1 (Fig. 9). It may be that older !Nara plants are usually replaced as flooding erodes the mounds and encourages new germination. However, this process would have ceased with the construction of the protection wall.

II. Floods and Germination

There are generally two methods by which plants adjust to the desert environment. The first method is to alter the plant structure to enable growth under more stressful conditions; the other is for the plant to enter dormancy to evade stress. The release of the seeds while a plant is dormant is usually induced by increased moisture in the desert. Sand must contain moisture for at least 4 days for the dormant release of the !Nara seed to occur (Moser, 2001). It therefore seems that seed germination is hindered in the tributary region because of a lack of sufficient water to induce dormant seed release.

III. Accumulation of Sand and Decreasing Underground Water Levels

A great deal of sand has accumulated in the area of the old riverbed, resulting in an increase in elevation of at least 10 m. This change makes it difficult, if not impossible, for young roots to reach the groundwater during the early stages of growth, increasing the difficulty of germination.

The growth rate of roots that germinate from seeds of the !Nara plant is far slower than that of many other plants growing in the desert (Moser, 2001). The seed roots of desert plants such as *Acacia nilotica* and *Mundulea sericea* grow at a rate of over 2 mm per day, but the !Nara seed root grows only 0.6 to 1.3 mm per day. Roots must grow as rapidly as possible to survive in the extremely dry environment of the desert. However, a major feature of the !Nara plant is this slow rate of growth (Moser, 2001). It is likely that many plants die before they can extend their roots to reach groundwater because of the arid conditions of the old riverbed.

The number of dams in the Kuiseb region has increased every year, from 152 dams in 1972 to 362 in 1997. These dams are constructed to meet the rise in demand for water in the cities. In addition, many pumps have been erected in the Kuiseb riverbed to extract more underground water to meet this demand.

Windhoek, the capital city of Namibia, lies upstream on the eastern side of the Kuiseb River. The rate of development in Windhoek has been remarkable, with a rapid increase in population that has brought with it an increase in the demand for water. Many of the dams in the Kuiseb River were constructed to meet this demand, and to secure the supply of water to the area.

The building of more dams and the use of groundwater have resulted in a marked decrease in the groundwater level. In the 1970s, the groundwater level at Rooibank was 2 to 4 m deep, fell to 8 m in 1988, and was recorded at 12.15 m in 1994. It is likely that the observed deterioration of !Nara plants in the region is owing to the accumulation of sand and the lowering of the groundwater table.

CONCLUSION

The Kuiseb delta contains the largest population of !Nara, and the Topnaar people are particularly dependent on the !Nara plant. Although this dependency has diminished over the last few decades, it is still vital to their survival. The life of the Topnaar will most certainly be jeopardized if the deterioration in the !Nara continues, and the harvest has already been reduced by half over the last 30 years.

The Kuiseb River experienced large-scale flooding 16 times over the past 160 years. However, in the last 50 years, only one large flood reached the Kuiseb delta. Instances of flood water reaching the !Nara fields are now quite rare.

Water from floods, the accumulation of sand, and the renewal of old plants are all necessary to the growth of !Nara. Owing to the construction of the flood protection wall in 1961, !Nara vegetation in the area has been nearly destroyed.

The decrease in flood water, lack of clearing of old !Nara plants, a decrease in reproduction, lack of dormant seed release, obstruction of germination, and an increased distance to groundwater owing to sand accumulation have all contributed to the decline in !Nara vegetation.

Many harvesters recognize that the crops are decreasing, but they lack a solution to the problem. Although crop deterioration has been confirmed only in the !Nara field near the tributary, the continued descent of the groundwater table, combined with a lack of flood water, will likely lead to further !Nara crop deterioration in the region of the main stream in the near future. Further study is required to investigate methods of improving the growth of !Nara, and to find solutions to the problems of the lowering groundwater table and the decrease in flooding.

ACKNOWLEDGMENTS This paper is based on a Master's thesis submitted to the

Graduate School of Asian and African Area Studies, Kyoto University. I appreciate the professors of Kyoto University, who provided valuable advice, and the institute for giving me this research opportunity. I also appreciate the support of the Desert Research Foundation of Namibia (DRFN) and the Gobabeb Training and Research Center (GTRC) for my research in Namibia.
This study was financially supported in part by a Grant-in-Aid for Scientific Research (Project No. 13371013 headed by Dr. Kazuharu Mizuno, Kyoto University) from the Ministry of Education, Science, Sports, Culture and Technology of Japan.

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———— Accepted *January 22, 2005*

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